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EDITORIAL

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Preface: Modelling and numerical simulations of dynamical systems

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For more than 20 years, a cyclical conference "Dynamical Systems—Theory and Applications" (DSTA) is organised by the Department of Automation, Biomechanics and Mechatronics of the Lodz University of Technology in Lodz, Poland. Its aim is to provide a common platform for exchange of new ideas and results of recent research works in the field of scientific and technological advances in modern dynamical systems. The last edition of the DSTA conference was attended by approximately 200 participants representing 28 countries, who presented 226 papers in total. On the basis of ten chosen papers, the authors prepared the extended and enhanced manuscripts, which constitute this volume.

Investigations dealing with the dynamics of a finite degree-of-freedom mechanical system with multiple sliding and unilateral frictional point contacts are presented in the paper by P. Varkonyi. Using the contact-mode-based approach combined with stability analysis carried out by means of compliant contact models, some new phenomena related to Painleve's classical paradox have been uncovered.

An attempt to raise train speed involves application of greater braking power, i.e. braking rapidly absorbing and dispersing stored heat energy. It generates many technical problems which can manifest, for example, high-amplitude vibrations of the vehicle and affect ride comfort. W. Sawczuk and G. Szymanski touch this subject in the article devoted to the determination of resonant frequencies of the selected railway disc brake elements.

G. Kudra and J. Awrejcewicz examine some special cases of smooth models of the resultant friction force occurring on a planar contact area. These models are very effective tools for fast and reliable analysis of a special kind of mechanical systems. The study is illustrated by the examples of self-excited bifurcation and chaotic dynamics as well as stick-slip behaviour of the pendulum with a special frictional driving.

One of the most destructive effects of earthquakes upon buildings and other constructions is due to the horizontal displacement of the ground. Y. Selyutskiy et al. propose in their paper a simplified approach to the description of behaviour of tower-like structures in such conditions.

In the paper by G. Sypniewska et al., the externally excited and damped vibrations of a double pendulum modelled as a piecewise smooth system are considered. An important element of the solving algorithm is the continuous tracking of the position of the pendulum in order to detect the collision with the unilateral constraints and to determinate the state vector of the pendulum at the moment of impact.

V. Böhm et al. discuss the rolling locomotion of mobile robots, based on a simple tensegrity structure, consisting of two disconnected tensional members connected to a continuous net of eight prestressed tensional members with pronounced elasticity.

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S. Lenci et al. consider the hardening and softening behaviour of the free non-linear dynamics, where the main point of investigations consists of detecting how the axial boundary conditions change the qualitative behaviour of the backbone curve.

The paper by P. Fritzkowski et al. is devoted to transverse in-plane vibrations of a beam which is a part of a symmetrical triangular frame. Dynamics of the system are studied numerically for various values of cross-sectional dimensions as well as the excitation amplitude and frequency. The regions related to regular and non-regular vibrations are determined in parameter planes by evaluation of the largest Lyapunov exponent.

Effectiveness of semi-active control systems with magnetorheological (MR) dampers to reduce lateral-torsional responses of irregular structures is the subject of the paper by M. Braz Cesar and R. Barros. Several numerical simulations comprising two-storey, one-bay building structure excited by an earthquake ground motion were used to demonstrate the effectiveness of a non-collocated passive and semi-active control systems in mitigating seismic-induced vibrations.

E. Patelli et al. address the problem of deterministic model updating. Two currently prominent stochastic model updating techniques (sensitivity-based updating and Bayesian model updating) are described and applied to the DLR AIRMOD structure.

As shown in this short review, the dynamical systems are present all around us and can take a variety of forms. Their in-depth knowledge is a challenge for researchers, but it can also be an interesting scientific adventure. We hope that reading this volume will be a pleasure for the reader and an inspiration for his own research.

Finally, we would like to express our deep appreciation to the Editor-in-Chief of the AAM journal, Professor Reinhold Kienzler, for his encouragement and continuous support of this SI project.

Guest Editors